

Systematic Virology

Collections



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RNA virus Families

① Single stranded RNA:

+ve sense

1. Picornaviridae:

- Non-enveloped (naked)
- Non-segmented
- VPg at 5' end
- polyadenylated (poly A tail) at 3' end

2. Caliciviridae:

- Non-enveloped (naked)
- Non-segmented
- VPg at 5' end
- polyadenylated (poly A tail) at 3' end
- 32 Cup-shaped surface depressions
- subgenomic RNA

3. Togaviridae:

- enveloped (Envelope loosely attached to capsid)
- Non-segmented
- Capped at 5' end
- polyadenylated (poly A tail) at 3' end
- subgenomic RNA
- arboviruses (seasonal disease)

4- Flaviviridae:

- enveloped
- Non-Segmented
- capped at 5' end
- No poly(A) tail at 3' end
- arboviruses (seasonal disease)
- ImmunoSuppression (Bovine virus diarrhea, related to G. pestivirus)

5- Coronaviridae:

- enveloped → with pear-shaped (club-shaped) peplomers (spikes) giving the virus Crown-Like or Solar appearance.
- Non-Segmented
- capped at 5' end
- poly(A) tail at 3' end
- Subgenomic mRNA
- Nested mRNA
- genetic reassortment
- curling and dwarfing in ECE (IBV)

-ve sense

1- paramyxoviridae:

- enveloped
- Non-Segmented
- contain F-protein (Fusion protein)
- have affinity to mucus

2. Orthomyxoviridae:

- enveloped
- Segmented (6-8 segments)
- have affinity to mucus
- genetic reassortment
- Base pairing of segment
- antigenic drift and shift
- Cap Snatching (nucleus)

3. Bunyaviridae:

- enveloped
- segmented (3 segments)
- ambisense
- genetic reassortment
- Base pairing
- Cap Snatching (cytoplasm)
- arboviruses
- Subgenomic mRNA

4. Rhabdoviridae:

- enveloped
- Non-segmented
- Subgenomic mRNA
- have terminal triphosphate at 5' end
- Bullet shape
- arboviruses
- Negri bodies (Rabies virus)

② double stranded RNA:

1- Birnaviridae:

- Non-enveloped
- Segmented (2 segments)
- ~~VPg~~ at 5' end of each segment
- have direct terminal repeats and Inverted terminal repeats at both ends.
- Base pairing
- Immuno suppression Virus (Infectious bursal disease)

2- Reoviridae:

- Non-enveloped
- Segmented (10-12 segments)
- Capped at 5' end of +ve sense strand and phosphorylated at 5' end of -ve sense strand.
- 2-3 Capsid Layers
- Incomplete uncoating virus
- Ring-shape Capsomers (orbivirus)
- genetic reassortment
- arboviruses.

DNA virus Families

1- Poxviridae:

- Lateral bodies
- Terminal Loop (TL)
- Inverted Terminal repeat (ITR)
- unique sequence (uS)
- Tandem repeats (CTR)
- cross-linked protein
- cytoplasmic replication and form ICB.
- genetic reassortment
- pock Lesion.

2- Herpesviridae:

- Tegument
- DNA wrapped around spool-like protein
- unique sequence
- genomic isomers
- Latent infection
- ImmunoSuppression
- Thymidine Kinase
- Intranuclear inclusion bodies
- pock Lesions
- In-ovo vaccination (Marek's disease virus)

• Virus Families Contain Segmented genome:

- 1- Orthomyxoviridae → 6-8 segments
- 2- Bunyaviridae → 3 segments
- 3- Reoviridae → 10-12 segments
- 4- Birnaviridae → 2 segments

• Genetic reassortment (Recombination):

- 1- Coronaviridae (Non-Segmented RNA)
- 2- Orthomyxoviridae
- 3- Bunyaviridae
- 4- Reoviridae
- 5- Poxviridae (DNA)

Segmented RNA

• Subgenomic mRNA:

- 1- Caliciviridae
- 2- Togaviridae
- 3- Coronaviridae (nested set of subgenomic mRNAs)
- 4- Bunyaviridae
- 5- Rhabdoviridae

• Cap Snatching occur in Some virus Families replication:

In nucleus
Orthomyxoviridae

In cytoplasm
Bunyaviridae

virus families transmitted through arthropods (insects) (carboviruses):

- 1- Togaviridae
- 2- Flaviviridae
- 3- Rhabdoviridae
- 4- Bunyaviridae
- 5- Reoviridae
- 6- Arenaviridae
- 7- Poxviridae

• Seasonal viral diseases (transmitted through arthropods):

- 1- Rift Valley Fever Virus
- 2- Blue tongue virus
- 3- African horse sickness
- 4- Bovine ephemeral fever
- 5- Sheep pox
- 6- Lumpy skin disease.

• virus families has VPG at 5' end of its genome:

- 1- Picornaviridae
- 2- Caliciviridae
- 3- Birnaviridae

virus families capped at 5' end of its genome:

- 1- Togaviridae
- 2- Flaviviridae
- 3- Coronaviridae
- 4- Reoviridae (Capped at 5' end of +ve sense strand)

virus families polyadenylated (has poly A tail) at 3' end of its genome:

- 1- Picornaviridae
- 2- Caliciviridae
- 3- Togaviridae
- 4- Coronaviridae

virus family has terminal triphosphate at 5' end of its genome:

Rhabdoviridae

virus families has base pairing of its genome:

- 1- Orthomyxoviridae
- 2- Bunyaviridae
- 3- Birnaviridae

virus families have affinity to mucus:

- 1- Paramyxoviridae (non-segmented genome)
- 2- Orthomyxoviridae (segmented genome)

virus family show genomic isomers

Herpesviridae

virus families have unique sequence in its genome:

- 1- Herpesviridae
- 2- Poxviridae

virus family has Terminal Loop or Tandem repeats or cross linked protein in its genome:

Poxviridae

• RNA virus family has direct terminal repeats and inverted terminal repeats at both ends:

Birnaviridae

• Virus Family has 32 cup-shaped surface depressions:

Caliciviridae

• Virus Family has an envelop loosely attached to nucleocapsid resembling Rouman mantle or cloak:

Togaviridae

• Virus Family has club-shaped peplomers "crown-like" in appearance:

Coronaviridae

• Fusion (F) protein is a part of a Virus Family envelop:

paramyxoviridae

• Virus Family has a bullet shape:

Rhabdoviridae

• Virus Family has 2-3 Capsid Layers:

Reoviridae

• Lateral bodies is a part of dsDNA
virus Family:
poxviridae

• virus Family has a tegument protein in its structure:

Herpesviridae

• virus Family undergo incomplete unCoating:

Reoviridae

• virus Family produce negri bodies

Rhabdoviridae (Rabies virus, related to G. Lyssa virus)

• virus Family undergo antigenic drift and shift:

1- Orthomyxoviridae (G. Influenza virus)
2- Bunyaviridae

• virus genus its Capsid contain ring-shaped Capsomers:

G. orbivirus related to F. Reoviridae

• Naked virus Family its genome is Segmented dsRNA and has one capsid layer

Birnaviridae

• virus Families under order Mononegavirales:

- 1- paramyxoviridae
- 2- Rhabdoviridae
- 3- Bornaviridae
- 4- Filoviridae

→ Mononegavirales means non-segmented -ve sense ssRNA.

• virus Families under order Nidovirales:

- 1- Family: Coronaviridae
 - subfamily: Coronavirinae
 - subfamily: Torovirinae

2- Family: arteriviridae

- 3- Family: Roniviridae

→ Nido from nidus meaning nest → due to transcription of nested set of mRNAs.

	picorna	Calicivirus	Toga	Flavi	Corona	paramyxo	orthomyxo	Bunya	Rhabdo	Reo	
strand	ss	-	-	-	-	-	-	-	-	-	DS DS
Segmentation	Non-segmented	-	-	-	-	→	Segmented (6-8)	Segmented (3)	Non-segmented	Segmented (10-12)	Segmented (2)
polarity	+ve sense	-	-	-	-	→	-ve sense	-ve sense	-ve or ambisense	-ve sense	double stranded
5' end	vpg	vpg	capped	-	-	→	-	-	-	-	cap at 5' end of +ve strand and P at 5' end of -ve strand
3' end	poly A	-	-	→	-	poly A	-	-	-	-	-
Subgenomic RNA	-	+	+	-	+	-	-	-	+	+	- -
genetic reassortment	-	-	-	-	+	-	+	+	+	-	+
Base pairing	-	-	-	-	-	-	+	+	-	-	+

Virus	Serotype	Antigenicity
1-FMDV	7 (A, O, C, SAT ₁ , SAT ₂ , SAT ₃ and ASIA)	No antigenic relationship
2-duck virus hepatitis	2-3 Serotypes of DHV	all strains are immunologically similar
3- avian encephalomyelitis	one antigenic serotype	all strains are immunologically similar
4- Bovine virus diarrhea (BVDV)	2 different biotypes (cytopathic and non-cytopathic strains)	close antigenic relationship with 1- Swine Fever virus 2- Border disease virus
5- Infectious bronchitis virus	several serotypes (7-8) but grouped into 2 types: • Connecticut • Massachusetts.	There is cross reaction between serotypes
6- Newcastle disease (NDV)	one Serotype antigenically	all strains are antigenically similar
7- Rinderpest (Cattleplague)	one Serotype (antigenically stable)	<ul style="list-style-type: none"> • Immunologically related to viruses that cause <ul style="list-style-type: none"> → Canine distemper → Measles → PPR. • close serologically with PPR.
8- avian Influenza	Many subtypes	No cross reaction between subtypes

9- Rift Valley Fever (RVF)	only one serotype	serologically related to other phleboviruses
10- Rabies	one serotype	antigenic relationship
11- bluetongue virus	25-26 different serotypes	less cross reaction between them
12- Infectious bursal disease (IBD)	2 serotypes (ST ₁ and ST ₂)	No antigenic relationship
13- Sheep pox	one serotype	cross reaction between members of genus Capripox (sheeppoxvirus, goatpoxvirus and LSDV)
14- Lumpy skin disease	one serotype	as sheep pox
15- Fowl pox		Fowl pox is closely related to pigeon pox
16- Infectious Laryngotracheitis (ILTv) (gallid herpes-virus - 1)	one serotype	all strains are antigenically similar
17- Marek's disease (MDV) (gallid herpes-virus - 2)	3 serotypes <ul style="list-style-type: none"> • S₁ (GHV₂) • S₂ (GHV₃) • S₃ (MHV₁) 	all strains are antigenically similar

viruses have only one serotype:

- 1- avian encephalomyelitis virus
- 2- Newcastle disease
- 3- Rinderpest (cattle plague)
- 4- Rift Valley Fever
- 5- Rabies
- 6- sheep pox
- 7- Lumpy skin disease.
- 8- Infectious Laryngotracheitis

viruses have more than one serotype:

- 1- FMDV
- 2- duck virus hepatitis
- 3- Bovine virus diarrhea
- 4- Infectious bronchitis virus
- 5- avian Influenza
- 6- Blue tongue
- 7- Infectious bursal disease
- 8- Marek's disease.

viruses causing immunosuppression:

- 1- Bovine virus diarrhea (BVDV) →
infect cattle
- 2- Infectious bursal disease (IBDV) →
infect birds

• virus cause immunotolerant or persistent infected calf:

Bovine virus diarrhea (BVDV)

• virus has cytopathic and non-cytopathic strains:

Bovine virus diarrhea (BVDV)

• virus undergo antigenic drift and shift resulting in either epidemic or pandemic disease.

avian Influenza virus

• viruses produce intracytoplasmic inclusion bodies:

- 1- Newcastle disease virus
- 2- cattle plague (Rinderpest)
- 3- Rabies virus (Negri bodies)
- 4- bluetongue virus
- 5- sheep poxvirus
- 6- Lumpy skin disease
- 7- Fowlpoxvirus

Viruses produce intranuclear inclusion bodies:

- 1- Newcastle disease virus
- 2- cattle plague (Rinderpest) virus
- 3- Rift Valley Fever
- 4- Infectious Laryngotracheitis (gallid herpesvirus-1)
- 5- Marek's disease (gallid herpesvirus-2)

Viruses produce pock lesions on CAM

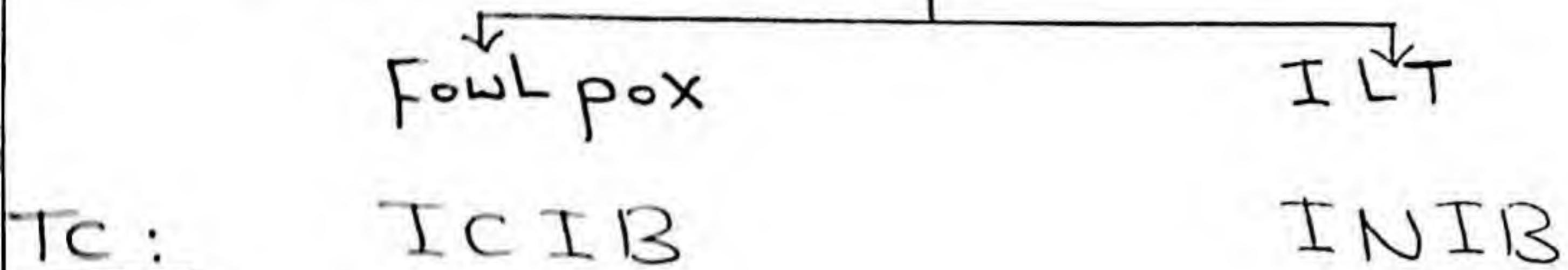
DNA viruses

- 1- sheep pox virus
- 2- Lumpy skin disease (LSD)
- 3- Fowl pox
- 4- Infectious Laryngotracheitis (ILT)
- 5- Marek's disease (MD)

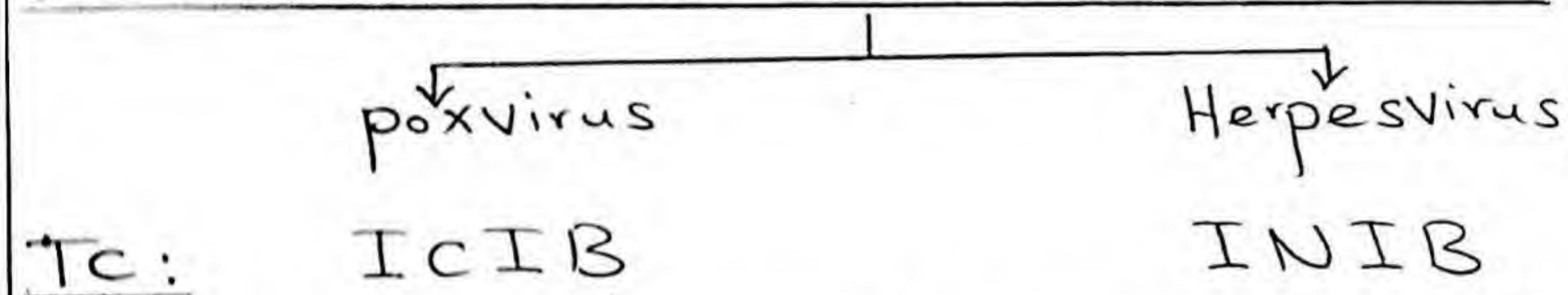
Viruses infect birds causing curling and dwarfing of embryo in ECEU

Infectious bronchitis virus (IBV)

• Viruses Causing diphtheritic membrane in chickens:



• Viruses isolated in ECE via CAM:

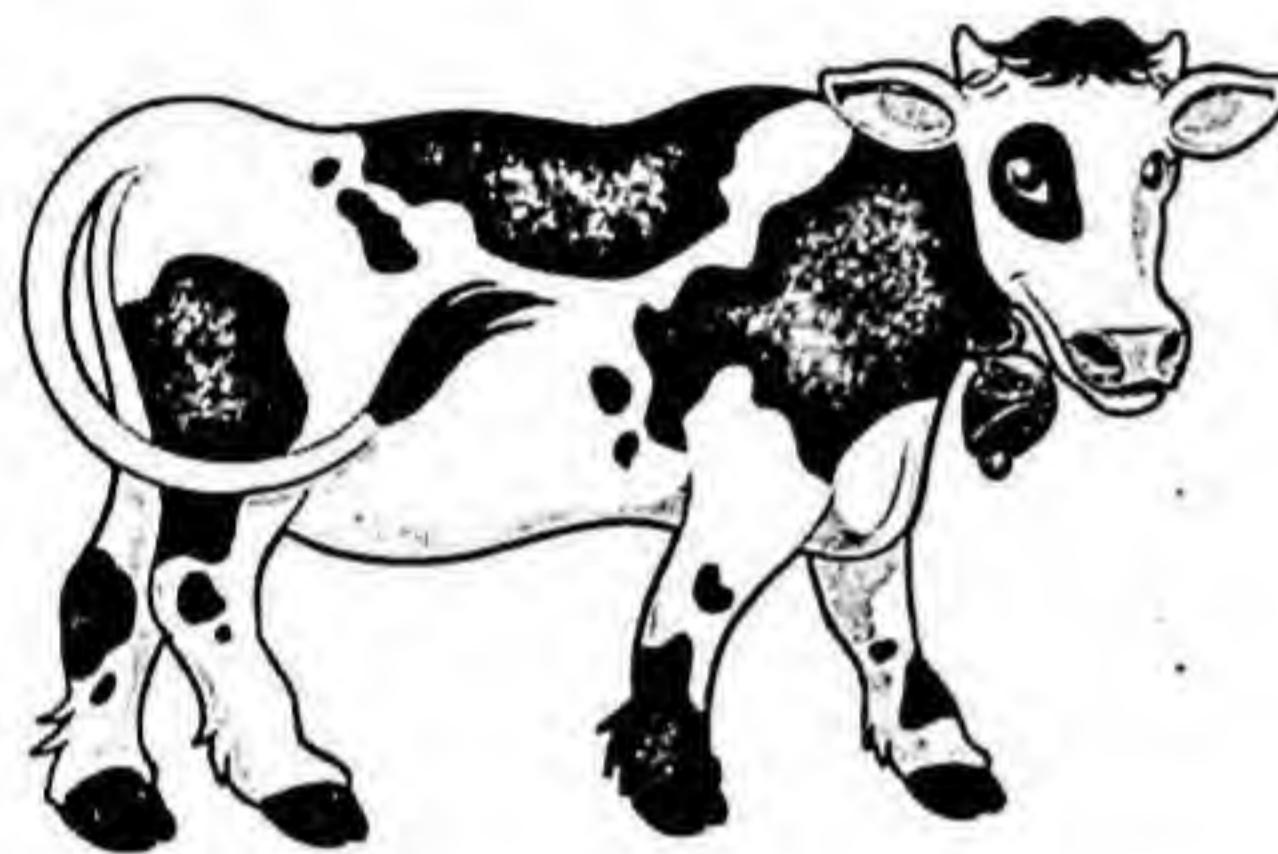


• Viruses Cause respiratory signs in poultry:

- 1 Newcastle disease (ND)
- 2 Avian influenza (AI)
- 3 Fowl pox
- 4 Infectious Laryngotracheitis (ILT)
- 5 Infectious bronchitis (IB)

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Summary Of Viral Diseases



Virus	Genus	SubFamily	Family	order
1 Foot and mouth disease (FMD)	Aphthovirus		Picornaviridae	Picornavirales
2 duck virus hepatitis (DVH)	Avihepatovirus			
3 Avian encephalomyelitis (AE)	Tremovirus			
4 Rabbit Hemorrhagic disease (RHD)	Lagovirus		Caliciviridae	
5 Bovine virus diarrhea (BVD)	pestivirus		Flaviviridae	
6 Avian infectious bronchitis (IB)	GammaCoronavirus	Coronavirinae	Coronaviridae	Nidovirales
7 Newcastle disease (ND) (avian paramyxovirus-1)	AVULavirus	Paramyxovirinae	paramyxoviridae	Mononegavirales
8 Rinderpestvirus (RPV)	Morbillivirus			
9 Avian influenza (fowl plague)	Influenza A virus		orthomyxoviridae	
10 Rift Valley Fever (RVF)	phlebovirus		Bunyaviridae	
11 Bovine Ephemeral Fever (BEF)	Ephemerovirus		Rhabdoviridae	Mononegavirales
12 Rabies virus	Lyssavirus			
13 Blue tongue (BT)	orbivirus	Sedoreovirinae	Reoviridae	
14 Infectious Bursal disease (IBD) (gumboro disease)	Avibirnavirus		Birnaviridae	
15 Sheep pox	Capripoxvirus	Chordopoxvirinae	Poxviridae	Poxvirales
16 Lumpy skin disease (LSD)				
17 Infectious Laryngotracheitis (ILT) (Gallid herpesvirus-1)	ILTVirus	alpha herpesvirinae	Herpesviridae	Herpesvirales
18 Marek's disease (MD) (Gallid herpesvirus-2)	Mardivirus	herpesvirinae		

	serotype and antigenicity	Lab. diagnosis	Vaccines																		
① Foot and mouth disease (FMD) (Aphthous fever)	<ul style="list-style-type: none"> • 7 Serotypes → A, O, C, SAT₁, SAT₂, SAT₃ and Asia₁ (named acc. to its area of origin) • Each serotype contain subtypes: <table border="0"> <tr><td>A</td><td>→ 32 subtypes</td></tr> <tr><td>O</td><td>→ 11</td></tr> <tr><td>C</td><td>→ 5</td></tr> <tr><td>SAT₁</td><td>→ 7</td></tr> <tr><td>SAT₂</td><td>→ 3</td></tr> <tr><td>SAT₃</td><td>→ 4</td></tr> <tr><td>Asia₁</td><td>→ 3</td></tr> </table> • antigenic variations occur due to antigenic drift (point mutation) in VP₁ • No cross reaction between these serotypes • In Egypt: <ul style="list-style-type: none"> → In the past O₁ → Now O₁, A₂₂ and SAT₂ 	A	→ 32 subtypes	O	→ 11	C	→ 5	SAT ₁	→ 7	SAT ₂	→ 3	SAT ₃	→ 4	Asia ₁	→ 3	<ul style="list-style-type: none"> • Specimens: <ul style="list-style-type: none"> → epithelial cover of vesicles → vesicular fluid → Ln, thyroid, heart • Lab. diagnosis: <ul style="list-style-type: none"> ① Rapid detection of viral Ag in clinical specimen (vesicular fluid or epith.) → CFT was used but now direct sandwich ELISA is used <table border="0"> <tr><td>+ve result</td><td>-ve result</td></tr> <tr><td>FMDV is present in the specimen</td><td>virus isolation to its titer after this repeat ELISA</td></tr> </table> ② Virus isolation in BHK-21: <ul style="list-style-type: none"> CPE → Rounding of the cell → pycnotic nucleus ③ Virus identification: <ul style="list-style-type: none"> • Serotype → determined by ELISA • subtype → determined by VNT ④ Serological test (ELISA) to detect 3 ABC or VIA antibodies <ul style="list-style-type: none"> → to differentiate between vaccinated and infected animal (vaccinated A' not contain these NSP) ⑤ Nucleotide sequencing of the VP₁ gene of an isolate → used for comparison with other isolates of the same serotype to determine the origin of outbreak ⑥ RT-PCR and Realtime RT-PCR 	+ve result	-ve result	FMDV is present in the specimen	virus isolation to its titer after this repeat ELISA	<ul style="list-style-type: none"> ① Inactivated vaccine <ul style="list-style-type: none"> Tc inactivated vaccine → was contained O₁ strain but now it contains serotypes O₁, A₂₂ and SAT₂ (Trivalent vaccine) in Egypt. ② Subunit vaccine: <ul style="list-style-type: none"> The vaccine contain VP₁ → prepared either by: <ul style="list-style-type: none"> DNA copy contain VP₁ gene ligated to E. coli plasmid. or peptide synthesizer
A	→ 32 subtypes																				
O	→ 11																				
C	→ 5																				
SAT ₁	→ 7																				
SAT ₂	→ 3																				
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Asia ₁	→ 3																				
+ve result	-ve result																				
FMDV is present in the specimen	virus isolation to its titer after this repeat ELISA																				

	Serotype and antigenicity	Lab. diagnosis	Vaccines
② duck virus hepatitis (DVH)	2-3 Serotypes of DVH مرض التهاب الكبد الوبائي في البط	<ul style="list-style-type: none"> Specimens: <ul style="list-style-type: none"> 1-Liver (10% Suspension) 2-blood Lab. diagnosis: <ul style="list-style-type: none"> ① Virus isolation: <ul style="list-style-type: none"> ECE via allantoic cavity: <ul style="list-style-type: none"> KILL 60% of embryos → Embryo → stunted growth hemorrhage in Liver and greenish in Colour. edematous all embryonic fluids are green. IM inoculation of one day old non infected duckling with Liver suspension → clear signs and lesions → reisolate the virus ② Virus identification: <ul style="list-style-type: none"> IFT, AGPT, VNT (duckling protection test) 	<ul style="list-style-type: none"> ① Live attenuated egg adapted vaccine given to breeding stock one day old duckling (via foot web)
③ avian encephalomyelitis (AE) (Epidemic tremors) مرض الإرتعاش الوبائي في الطيور	only one antigenic Serotype of AEV مرض الإرتعاش الوبائي في الطيور	<ul style="list-style-type: none"> Specimens: <ul style="list-style-type: none"> brain of infected chicks (10% Suspension) Lab. diagnosis: <ul style="list-style-type: none"> ① Virus isolation: <ul style="list-style-type: none"> ECE via yolk sac: <ul style="list-style-type: none"> Wait till hatching → after 10 d. → appearance of nervous signs in chicks (encephalitis) IC inoculation in one day old chick: <ul style="list-style-type: none"> take the brain → tissue section to detect viral Ag ② Virus identification: <ul style="list-style-type: none"> IFT, AGPT, ELISA 	<ul style="list-style-type: none"> ① Live attenuated egg adapted vaccine given for adult chicken ② Inactivated Vaccine

④ Rabbit hemorrhagic disease (RHD) هرمن التزف الدموي للغروس في الأرانب	Serotype and antigenicity Lab. diagnosis	Vaccines																																
⑤ Bovine virus diarrhea (BVD) هرمن الاهوال الفيروسي في الأبقار	<ul style="list-style-type: none"> There are <u>2 different genotypes</u> acc. to difference of the 5' UTR of the viral genome → <u>BVD₁</u> and <u>BVD₂</u> There are <u>2 different biotypes</u> acc. to growth characteristics of the virus in cell culture <ul style="list-style-type: none"> cytopathic virus (CP) Noncytopathic (NCP) There is close antigenic relationship between: <ul style="list-style-type: none"> → BVDV → border disease virus → swine fever virus <p>Specimens:</p> <ul style="list-style-type: none"> → Fresh rabbit tissues of Liver, Spleen, Lung and blood. (for virus isolation) → Formalin fixed tissues (for IF or IP) → all excretions <p>Lab. diagnosis:</p> <ol style="list-style-type: none"> <u>Virus isolation:</u> Virus <u>not grow</u> on TC So rabbits are used for propagation, isolation and titration of RHDV <u>Virus identification:</u> Viral Ag detected by IF, IP and ELISA <u>EM (Immunoelectron microscope):</u> used to detect the virus <u>Ab identification:</u> <ul style="list-style-type: none"> • HI (RHDV cause HA of <u>human type O RBCs</u>) • ELISA, Western blotting technique <u>RT-PCR</u> <p>Specimens:</p> <ul style="list-style-type: none"> → whole blood (buffy coat) - sera paired → Feces, Ln, intestine → aborted fetus <p>Lab. diagnosis:</p> <ol style="list-style-type: none"> <u>Virus isolation:</u> in MD BK → <u>cytopathic BVDV</u> produce CPE <ul style="list-style-type: none"> → damage to cell membrane → cell rounding - vacuole formation → grape-like clusters → ICI B <u>Virus identification:</u> <table border="0"> <tr> <td><u>CP biotype</u></td> <td><u>NCP biotype</u></td> </tr> <tr> <td>NT, ELISA</td> <td>IF, IP, Interference test</td> </tr> <tr> <td><u>3) viral Ag detection</u></td> <td>IF</td> </tr> <tr> <td><u>4) Multiplex PCR</u></td> <td>Immunohistochemical staining Ag capture ELISA</td> </tr> </table> 	<u>CP biotype</u>	<u>NCP biotype</u>	NT, ELISA	IF, IP, Interference test	<u>3) viral Ag detection</u>	IF	<u>4) Multiplex PCR</u>	Immunohistochemical staining Ag capture ELISA	<p>Inactivated homogenate of infected rabbit Liver mixed with adjuvant.</p> <p>① Inactivated Tc vaccine</p> <table border="0"> <tr> <td>pneumo 3</td> <td>pneumo 4</td> <td>pneumo 5</td> </tr> <tr> <td>BVDV</td> <td>BVDV</td> <td>BVDV₁</td> </tr> <tr> <td>IBRT</td> <td>IBRT</td> <td>BVDV₂</td> </tr> <tr> <td>PI₃</td> <td>PI₃</td> <td>IBRT</td> </tr> <tr> <td></td> <td></td> <td>PI₃</td> </tr> <tr> <td></td> <td></td> <td>BRSV</td> </tr> <tr> <td></td> <td></td> <td>PI₃</td> </tr> <tr> <td></td> <td></td> <td>BRSV</td> </tr> </table> <p>② Live attenuated Tc vaccine: Not used in pregnant A' and in persistent infected A' as it lead to mucosal disease</p> <p>③ Temperature sensitive mutant vaccine</p>	pneumo 3	pneumo 4	pneumo 5	BVDV	BVDV	BVDV ₁	IBRT	IBRT	BVDV ₂	PI ₃	PI ₃	IBRT			PI ₃			BRSV			PI ₃			BRSV
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Infection of pregnant cow by BVDV:

- Infection of pregnant cow with NCP biotype of BVDV differ acc. to stage of embryo:

① Very early infection (\downarrow 80 days):

Embryonic death and resorption with infertility and repeat breeder in cows.

② Infection at 80 - 125 days:

- The virus affect the organogenesis and cause defects in eye (Retinal dysplasia) and CNS (Cerebellar hypoplasia and activation of cerebrum) \rightarrow Fetal death.
- or Lead to weak calf syndrome \rightarrow The calf survive and become persistent infected (act as a carrier and shed the virus in all its secretions and excretions) \rightarrow The calf not produce Abs against the virus (seronegative) (Immunotolerant).

③ Infection after 125 days:

The calf survive and shed the virus and produce Abs.

- Later (6 months to 2 years of age) \rightarrow Cytopathic biotype arise from NCP BVDV as a result of recombination that include
 - Insertion of host RNA.
 - duplication of viral RNA sequence
 - mutation in the NS 2-3 gene.

- Cytopathic mutant may result from recombination between NCP virus and superinfecting heterotypic cytopathic virus (as occur in Vaccine associated outbreaks).
- The result is Mucosal disease.

الطيبون قناديل قليل

لكن نور هم يضئ الكون بأكمله

أكر مكم ربى بداعوه لاترد

ورزق لا يعد

وباب الي الجنة لا يسد ويسر

الله اموركم لما يود.. أمين

	Serotype and antigenicity	Lab. diagnosis	Vaccines
6 Avian Infectious bronchitis (IB) مرض الالتهاب العصري في الطيور	<p>due to mutation of S-protein gene, there are <u>several Serotypes</u> of IBV (7-8) but they are grouped into 2 types:</p> <ul style="list-style-type: none"> Connecticut Massachusetts <p>→ There is cross reaction between serotypes</p>	<ul style="list-style-type: none"> Specimens: trachea, bronchi and Lungs Lab. diagnosis: <ol style="list-style-type: none"> Virus isolation: <ul style="list-style-type: none"> ECE via allantoic cavity → dwarfing and curling of embryos (ball-like) Tracheal organ culture (TOC) → sloughing of cilia direct detection of virus in tissue section by IFT (rapid diagnostic test) 	<ol style="list-style-type: none"> Live attenuated Virus Vaccine (Massachusetts) Inactivated Virus Vaccine
7 Newcastle disease (ND) (paramyxovirus -1) مرض النيوكاسل أو الشوطة في الطيور	One Serotype antigenically	<ul style="list-style-type: none"> Specimens: <ul style="list-style-type: none"> tracheal and cloacal swabbing Lung, brain, spleen, liver and kidneys Lab. diagnosis: <ol style="list-style-type: none"> Virus isolation (Cultivation) <ul style="list-style-type: none"> a- ECE via allantoic cavity: <ul style="list-style-type: none"> death of embryo hemorrhage on skin, wing and leg of embryo allantoic fluid → + HA confirmed by HI b- TC: BHK 21 or chicken embryo fibroblast CPE → Syncytia formation → Inclusion bodies → HD c- Lab. A: IC in mice → nervous symptoms Immunological tests: ELISA, HI 	<ol style="list-style-type: none"> Live attenuated vaccine: <ul style="list-style-type: none"> prepared from mesogenic strain → as Komarov, Mukteswar Lentogenic strain → as F-strain, Hitchner B1, Lasota Inactivated Vaccine Recombinant Vaccine <p>For HN genes with fowl pox or other viruses</p>
8 Rinderpest (Cattle plague) الطاعون البقرى	<p>Only one serotype</p> <ul style="list-style-type: none"> Immunologically related to viruses that cause Canine distemper Measles PPR close serologically with PPR 	<ul style="list-style-type: none"> Specimens: conjunctival fluid, feces, citrated whole blood (buffy coat), intestine Virus present in blood and secretions before symptoms appear. Lab. diagnosis: <ol style="list-style-type: none"> Impression smear: Examination of stained impression smear prepared from epithelia of tonsils and other lymphoid tissues → Syncytia formation Virus isolation: ICIB <p>TC → Syncytia formation + ICIB</p>	<ol style="list-style-type: none"> Inactivated Vaccine Live attenuated vaccine <ul style="list-style-type: none"> Caprinized → 250 passage Lapinized → 100 avianized → 19-25 Tc Vaccine → 70 <p>In Egypt: Live attenuated Tc Vaccine contain Kabete o strain.</p> <p>3 Recombinant vaccination Capripox virus vaccine</p>

serotype and antigenicity	Lab. diagnosis	Vaccine
<p>⑨ avian influenza (Fowl plague) (Bird Flu)</p> <p>العلو نزا المبرور</p> <p>Many Serotypes acc. to Surface antigens (HA and NA)</p> <ul style="list-style-type: none"> • HA → 18 • NA → 11 → Most Common Subtypes → H5N1, H5N2, H7N5 • antigenic Variation of avian influenza virus → antigenic drift → antigenic shift • No cross reaction between subtypes. 	<p>Specimens:</p> <ul style="list-style-type: none"> 1-Live birds → Nasal, tracheal and cloacal swabs, sinus exudate, blood and paired sera 2-dead birds → tracheal and Lung tissue, pooled tissue of organs <p>Lab. diagnosis:</p> <ol style="list-style-type: none"> ① Virus isolation: <ul style="list-style-type: none"> • ECE via allantoic cavity → testing the allantoic fluid by HA test → then HI test. • Tc: MDCK → CPE → ICIIB and INIB <ul style="list-style-type: none"> → giant cells and plaques → testing of Tc fluid by HA and HI → testing of infected cells by HD ② Virus identification: <ul style="list-style-type: none"> using known antisera to detect internal NP antigen (typing of isolate) → by serological tests as IFT. ③ Subtyping: <ul style="list-style-type: none"> using MAbs against HA(18) and NA(11) antigens using HI and NI tests ④ detection of Abs → by HI test ⑤ pathogenicity test (Live bird challenge test) IC in 1 day old chickens → 75-100% mortality ⑥ DIVA (differentiating infected from vaccinated animals): depend on presence of <u>NS1 protein</u> in infected bird not in vaccinated one → detected by using <u>anti-NS1 protein</u> using IFT. ⑦ genome sequence detection and analysis: RT-PCR used to amplify HA gene then sequencing 	<p>① Inactivated Virus Vaccine</p> <p>② Live attenuated Vaccine (FluMist)</p> <p>③ Recombinant HA protein vaccine or Recombinant Fowl pox virus vector vaccine</p>

Serotype and antigenicity	Lab. diagnosis	Vaccine
10 Rift Valley Fever (RVF) (Enzootic hepatitis) حمى الوادى المتبع في الأعشاب	<ul style="list-style-type: none"> only one serotype Serologically related to other phlebo-viruses. <p>Specimens: blood, Liver, brain, freshly aborted fetus and placenta</p> <p>Lab. diagnosis:</p> <ol style="list-style-type: none"> Virus isolation: <ul style="list-style-type: none"> Lab. A' → IC inoculation of blood in baby mice or adult mice → fatal hepatitis Tc (Vero Cells - BHK 21) → CPE (plaques and inclusion bodies) Virus identification: SNT Histopathological examination of Liver → characteristic lesion and inclusion bodies Ag detection in impression smears of Liver, spleen and brain → by IFT 	<p>1 Live attenuated vaccine: may cause abortion and birth defects in pregnant A' mice</p> <p>2 Inactivated vaccine: In Egypt: Inactivated Tc vaccine contain the local strain (zagazig strain)</p>
11 Bovine ephemeral fever (BEF) (3-day sickness) حمى التلاش أيام الأبقار	<p>Specimens: citrated blood (buffy coat) during fever, Lung, Ln</p> <p>Lab. diagnosis:</p> <ol style="list-style-type: none"> Virus isolation: difficult Lab. A' → I/C inoculation of buffy coat in suckling mouse brain. Tc (Vero Cells, BHK-21) → CPE <ul style="list-style-type: none"> Cell rounding Cell detachment Plaque formation 	<p>1 Live attenuated virus vaccine (Australia)</p> <p>2 Inactivated vaccine</p>

	Sevotype and antigenicity	Lab. diagnosis	Vaccine																
12 Rabies	<p>There is only one serotype of Rabies virus.</p> <p>Types of Rabies Virus:</p> <ul style="list-style-type: none"> 1 <u>street virus</u> → strains of rabies virus occurring in animal under natural conditions 2 <u>fixed virus</u> → strains of rabies virus adapted in Lab. animals. 	<p>Specimens: brain (hippocampus, cerebellum and cerebral cortex) placed in 50% glycerol saline.</p> <p>Lab. diagnosis:</p> <ol style="list-style-type: none"> 1 <u>Histopathological examination of impression smear or histological section of brain tissue stained by SELLer's stain</u> → For detection of <u>Negri bodies</u> in cytoplasm. 2 <u>Immunofluorescence (IFT)</u>: used for rapid detection of viral Ag in brain (infected dog or inoculated mice) and Tc. 3 <u>Animal inoculation</u>: IC inoculation of mice with brain suspension → muscular tremors, paralysis and death. 4 <u>RTCIT (Rabies Tc infection test)</u>: Virus isolation in neuroblastoma or BHK cells → detection of rabies virus by FAT. 5 <u>Serology</u> → FAT 6 <u>RT- PCR</u> 	<p>① <u>Modified Live Virus Vaccine</u>:</p> <ul style="list-style-type: none"> • Canine Cell Line origin (HEp, Flury strain) • porcine Tc origin. <p>② <u>Inactivated Virus Tc Vaccine</u>: BHK-21</p> <p>In Egypt:</p> <ol style="list-style-type: none"> 1- <u>Avianized rabies vaccine</u>: Live attenuated vaccine contain Flury strain (LEP) 2- <u>Inactivated Tc Vaccine</u>: propagated in BHK-21 																
	<table border="1"> <thead> <tr> <th>Street strain</th> <th>Fixed strain</th> </tr> </thead> <tbody> <tr> <td>Isolated from diseased animal</td> <td>Lab. adapted strains</td> </tr> <tr> <td>Long incubation period</td> <td>Short incubation period.</td> </tr> <tr> <td>produce ICIB (Negri bodies)</td> <td>Not produce Negri bodies.</td> </tr> <tr> <td>have tropism to salivary gland, eye, brain and skin</td> <td>have tropism only to brain tissue</td> </tr> <tr> <td>highly pathogenic for animal and man</td> <td>Less pathogenic</td> </tr> <tr> <td>Not used in vaccine preparation</td> <td>Used in vaccine preparation</td> </tr> <tr> <td>presence of Arginine and Lysin residue at position 333 of G-protein.</td> <td>Not present</td> </tr> </tbody> </table>	Street strain	Fixed strain	Isolated from diseased animal	Lab. adapted strains	Long incubation period	Short incubation period.	produce ICIB (Negri bodies)	Not produce Negri bodies.	have tropism to salivary gland, eye, brain and skin	have tropism only to brain tissue	highly pathogenic for animal and man	Less pathogenic	Not used in vaccine preparation	Used in vaccine preparation	presence of Arginine and Lysin residue at position 333 of G-protein.	Not present		
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	serotype and antigenicity	Lab. diagnosis	Vaccine						
13 Blue Tongue (BT) (Covine Catarhal Fever, Sore mouth) مرض اللسان الأزرق في الأغام	<ul style="list-style-type: none"> There are 25-26 different serotypes In Egypt: Serotypes 1, 4, 12 and 16 Each type produce solid homologous immunity but give a variable degree of protection to heterologous challenged type. 	<ul style="list-style-type: none"> Specimens: <ul style="list-style-type: none"> Citrated blood collected at febrile stage (buffy coat) → BTV affect endothelial and hemopoietic cells Spleen and Ln. Lab. diagnosis: <ol style="list-style-type: none"> Virus isolation: ECE (YS, CAM or IV route) → death of embryo with multiple hemorrhage → Infected CAM used as source of virus Ag in VNT, CFT and ELISA test. Lab. A: → in the brain of unweaned mice and hamsters → encephalitis and death Tc (BHK 21, MS) → TCID₅₀ 	<ol style="list-style-type: none"> Live attenuated Virus Vaccine disadv.: → abortion and fetal death → use of multivalent vaccine can lead to emergence of genetic reassortants. In Egypt: Tc attenuated vaccine prepared in MS cells. 						
14 Infectious Bursal disease (IBD) (Gumboro disease) مرض الجمورو أو الدز الكبور	<ul style="list-style-type: none"> There are 2 serotypes <table border="1"> <tr> <td>ST₁</td> <td>ST₂</td> </tr> <tr> <td>→ pathogenic</td> <td>→ avirulent</td> </tr> <tr> <td>→ mainly affect chicken</td> <td>→ affect chicken, ducks and turkeys.</td> </tr> </table> <p>ST₁</p> <p>↓ Mutation in VP₂</p> <p>virulent ST₁ (vST₁)</p> <p>↓ Mutation</p> <p>very virulent ST₁ (vvST₁)</p>	ST ₁	ST ₂	→ pathogenic	→ avirulent	→ mainly affect chicken	→ affect chicken, ducks and turkeys.	<ul style="list-style-type: none"> Specimens: bursa of fabricius, Liver, spleen, kidney and Lung Lab. diagnosis: <ol style="list-style-type: none"> Virus isolation: ECE (via CAM): death of embryo with S/C edema, hemorrhages, stunted growth, mottled hemorrhages in Liver Tc (chicken embryo kidney cell culture): CPE → cell necrosis and plaque formation 	<ol style="list-style-type: none"> Live attenuated Virus Vaccine prepared in vero cells Inactivated Vaccine Safe Recombinant Vaccine: recombinant fowl pox virus vector vaccine (expressing VP₂ gene)
ST ₁	ST ₂								
→ pathogenic	→ avirulent								
→ mainly affect chicken	→ affect chicken, ducks and turkeys.								

<p>15 Sheep pox</p> <p>جدران الأغشية</p>	<p>serotype and antigenicity only one serotype</p> <ul style="list-style-type: none"> There is cross reaction between sheep pox virus, goat pox virus and LSDV (members of genus Capripoxvirus) <p>Lab. diagnosis</p> <ul style="list-style-type: none"> Specimens: <ul style="list-style-type: none"> blood (during viremia) skin pox lesions lung - serum Lab. diagnosis: <ol style="list-style-type: none"> detection of ICIB in histological section stained by H&E Rapid detection of virus by EM or FAT Virus isolation: <ul style="list-style-type: none"> ECE via CAM → pock lesions TC → clear CPE (ICIB) Ag capture ELISA → for viral Ag detection. Ab identification: by VNT, Indirect FAT, Indirect ELISA PCR 	<p>Vaccines</p> <ol style="list-style-type: none"> Live attenuated vaccines <p>In Egypt: prepared from Roumanian sheep pox virus → injected I/d in hairless area (under tail)</p> <ol style="list-style-type: none"> Inactivated virus vaccine: <p>Inactivated by formalin</p>
<p>16 Lumpy skin disease (LSD)</p> <p>حرب الخلايا فقدان الأبكار</p>	<p>only one serotype</p> <ul style="list-style-type: none"> There is cross reaction between sheep pox virus, goat pox virus and LSDV. Sheep pox (Kenyan strain) is identical to Neethling strain of LSDV. <p>Lab. diagnosis:</p> <p>as Sheep pox</p>	<ol style="list-style-type: none"> Sheep pox virulent vaccine: <p>propagated in TC (Heterologous vaccine)</p> <ol style="list-style-type: none"> attenuated Neethling virus strain: <p>60 passages in Lamb Kidney TC followed by 20 passages in chicken embryo</p>

	serotype and antigenicity only one serotype	Lab. diagnosis	Vacc.
17 Infectious Laryngo-Tracheitis (ILT) (gallid herpesvirus -1) مرض التهاب الحنجرة والقصبة الهوائية المعدية في الطيور	<ul style="list-style-type: none"> specimens: Tracheal exudate Lung suspension Lab. diagnosis: <ol style="list-style-type: none"> detection of INIB in histological section (tracheal tissue) Rapid detection of virus in tracheal exudate by EM or FAT. virus isolation: <ul style="list-style-type: none"> ECE via CAM → pock lesion Tc → INIB viral Ag detection in tracheal sample by FAT, ELISA, AGpt. Ab identification by VNT, ELISA PCR 	<ol style="list-style-type: none"> Live Virus. Virus (low virulence) used by cloacal vaccination Live attenuated vaccine given by infra-orbital sinus or intranasal or eyedrops route 	
18 Marek's disease (MD) (gallid herpesvirus -2) مرض ماريله في الطيور	<ul style="list-style-type: none"> There are 3 serotypes: <ol style="list-style-type: none"> S1 (GHV2): • Mostly cause Marek's disease • pathogenic, oncogenic • affect chicken S2 (GHV3): • Non-pathogenic, Non oncogenic • affect chicken. S3 (MHV1): • avirulent, non oncogenic • affect turkeys • ALL strains are antigenically similar. 3 viral Ag (A, B, C): → A (cell free Ag) → B, C (cell associated Ag integrated in cell). • one non viral Ag (MATSA "Marek associated tumor surface Ag") formed on surface of infected cell. 	<ul style="list-style-type: none"> specimens: heparinized blood (buffy coat) spleen, tumor tissue feather follicle epith. Lab. diagnosis: <ol style="list-style-type: none"> Rapid detection of viral Ag in feather follicle by direct FAT. virus isolation: <ul style="list-style-type: none"> ECE via CAM → pock lesion Tc → INIB detection of MATSA on cell surface of tumor tissue → by using known Abs → by IFT. Ab identification: by VNT, Indirect FAT, ELISA PCR 	<ol style="list-style-type: none"> Herpes Virus of turkey (HVT) (Heterologous vaccine) Live attenuated Tc vaccine: vaccinate embryo at 18th day old (In-ovo vaccination) Recombinant vaccine

Q) Enumerate viral diseases causing respiratory manifestations in poultry and how can you differentiate between them laboratory.

↓
ND AI ILT Fowlpox IB

	CAM inoculation	Effect on embryo	HA on allantoic fluid
ND	No gross Lesion	Lethal 48-72 hrs	+ve HA
AI	No gross Lesion	Lethal	+ve HA
ILT	pock Lesion	No gross Lesion	-ve HA
Fowlpox	pock Lesion	No gross Lesion	-ve HA
IB	No gross Lesion	Curling and dwarfing	-ve HA

• differentiation between ND and AI → by HI (Haemagglutination inhibition test)

• differentiation between ILT and Fowlpox

↓
ILT Fowlpox
Intranuclear inclusion bodies Intracytoplasmic inclusion bodies

Viral diseases

Cattle diseases:

- 1) FMD → vesicle in mouth and foot
- 2) BVD → diarrhea, abortion
Immunosuppression
- 3) Rinderpest → Four D's = diarrhea, dehydration
- 4) Rift Valley fever → depression, death
- 5) Bovine ephemeral fever → Lameness, stiffness
- 6) Rabies
- 7) Lumpy skin disease → skin nodules
sit fast
abortion
- 8) BSE (mad cow disease) → nervous signs

Sheep diseases:

- 1) FMD
- 2) Rift Valley fever → death of young
abortion
- 3) Blue tongue → purplish blue tongue
- 4) Rabies → abortion
- 5) Sheep pox → skin pox Lesions
death of young
- 6) Scrapie → Nervous signs

Rabbit disease:

Rabbit hemorrhagic disease (RHD) → Sudden death of rabbit (↑ 2 months) and unique intravascular Coagulopathy

Dog disease:

Rabies → great excitement, paralysis, hydrophobia

Poultry diseases:

- 1) Duck virus hepatitis → fall on their sides
→ kick spasmodically
- 2) Avian encephalomyelitis → ataxia and paralysis
- 3) Infectious bronchitis (IB):
resp. signs, nephritis, ↓ egg production
- 4) Newcastle disease (ND):
resp. signs, nervous and enteric signs
- 5) Avian influenza (AI):
↑ mortality, resp. signs, edema of head,
↓ egg production.
- 6) Infectious bursal disease (IBD) (gumboro disease) → diarrhea with soiled vent
→ bursa enlarged then atrophied
- 7) Fowl pox
- 8) Infectious laryngotracheitis (ILT):
resp. signs, expectoration of caseous bloody exudate.
- 9) Marek's disease:
paralysis, tumors, grey eye and irregular, eccentric pupil



ج. زهراء
ZHR
ZHB
ج.

شجرة اللثرة

تناثر الكلمات حبراً وحباً

على صفحات الأوراق

لكل من علمني

ومن أزال غيمة جهل عررت بها

برباع العلم الطيبة

ولكل من أعاد رسم علافي

وتصحيح عنترائي

أبعث تحيات شلر وأحترام